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PREPARATION OF GROUP CONSTANTS FOR NEUTRON SHIELDING CALCULATIONS FROM THE EVALUATED NUCLEAR DATA AVAILABLE FROM IAEA

Hungarian Academy of Sciences

CENTRAL RESEARCH INSTITUTE FOR PHYSICS

BUDAPEST

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Up to now a group-constant library prepared from the ABBN [1] data has been in use in our laboratory for neutron shielding calculation. However this library is not quite adequate for the purpose, because its group mesh is too coarse in the high energy range.

The KEDAK evaluated nuclear data files being made available by IAEA [2] have given us the possibility of producing a group-constant set with more adequate group scheme.

The program ZEBRA-2 producing this group-constant set is based mainly on the program ZEBRA-1 [3], which produces a forty-group MUFT constant library. The difference between the programs lies in the calculation of the elastic transfer matrix, whixh has been taken over from PRODGROUP [4].

The starting point for ZEBRA-2, as for ZEBRA-1, is DF1 [4]. Its final product is a group-constant file on a magnetic tape that is used by the program MUSHPALB [5] to calculate the spectra of neutrons transmitted through multilayer shieldings. A group-constant library tape of this format was originally produced from ABBN data [6].

The INPUT scheme for ZEBRA-2 is the following:

CARD	FORMAT	I/O LIST	Description
1	210	MSZ1, MSZ2	MSZ1=30, the group-constant library tape is continued, MSZ1=32, otherwise; MSZ2 =31, a new library tape is created; MSZ2=31, an old library tape is over-written; MSZ2=29, the new library elements will be written on MSZ1.
2	310	NG,IQ,IK1/3/	NG = number of groups; IK1/3/=number of elements in the library; if IQ=0 then the ABBN group mesh is used, otherwise the following record is input:
3	10F0.0	UG/I/,I=1,NG	group boundaries
4	3F0.0	TEMP,T1,T2	TEMP = the thermal cut-off energy in eV,T1= =fission spectrum cut-off energy in MeV, T2=material temperature in eV

5	2I0,2F0.0	ND/I/	serial number of data groups of I-th elements on DF1
		IH/I/	=0, no inelastic matrix should be calculated, ≠0, otherwise
		ETK/I/	energy in eV above which the anisotropy of elastic scattering should be taken into account
		AT/I/	atomic mass number

The last card is repeated for each element. The order of elements should be the same as that on DF1.

The experimental curves published in [8] have been used for testing the ZEBRA-2. In the case of graphite a 12 group system with upper boundaries 10,9,8,7,6,5,4,3,2,1,0.5MeV and 0.625eV and in the case of iron a 17-group system with upper boundaries 15,14,13,12,11,10,9,8,7,6,5,4, 3,2,1,0.5MeV and 0.625eV have been used. The transmitted neutron spectra have been calculated by MUSHPALB [5]. The results are shown on Fig. 1-2. It is seen that the calculated spectra are below the experimental ones, however in this region the measured spectra are largely effected by the background radiation.

REFERENCES

[1] L.P. Abagyan et.al. Group constants for reactor calculation. Atomizdat, 1964 /In Russian/

[2] D. Woll, KFK-880/1968/

[3] P. Vértes, INDC/HUN/ 6/L /IAEA report/

[4] P. Vértes, KFKI-71-4 /1971/

[5] P. Vértes, KFKI-70-37 RPT /1970/

[6] P. Vértes, KFKI-14/1968.

[7] A.P. Veselkin et.al. Atomnaya Energiya 26, 523 /1969/

[8] A.P. Veselkin et.al. Atomnaya Energiya 16, 32 /1964/

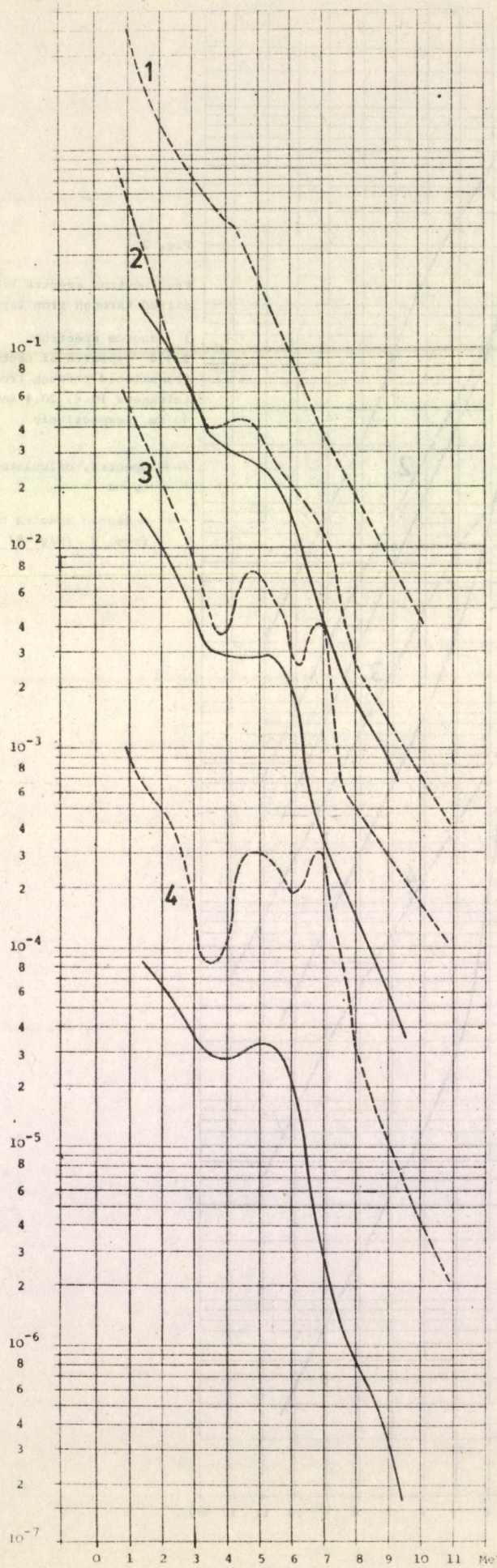

Fig. 1

Fast neutron spectra transmitted through graphite layers.

1 - source spectrum,
2,3,4 - spectra of neutrons transmitted through graphite of thickness 22.5, 45 and 92.5 cm, respectively

—— spectra, calculated by us

---- measured spectra taken from 8 /Fig. 4/

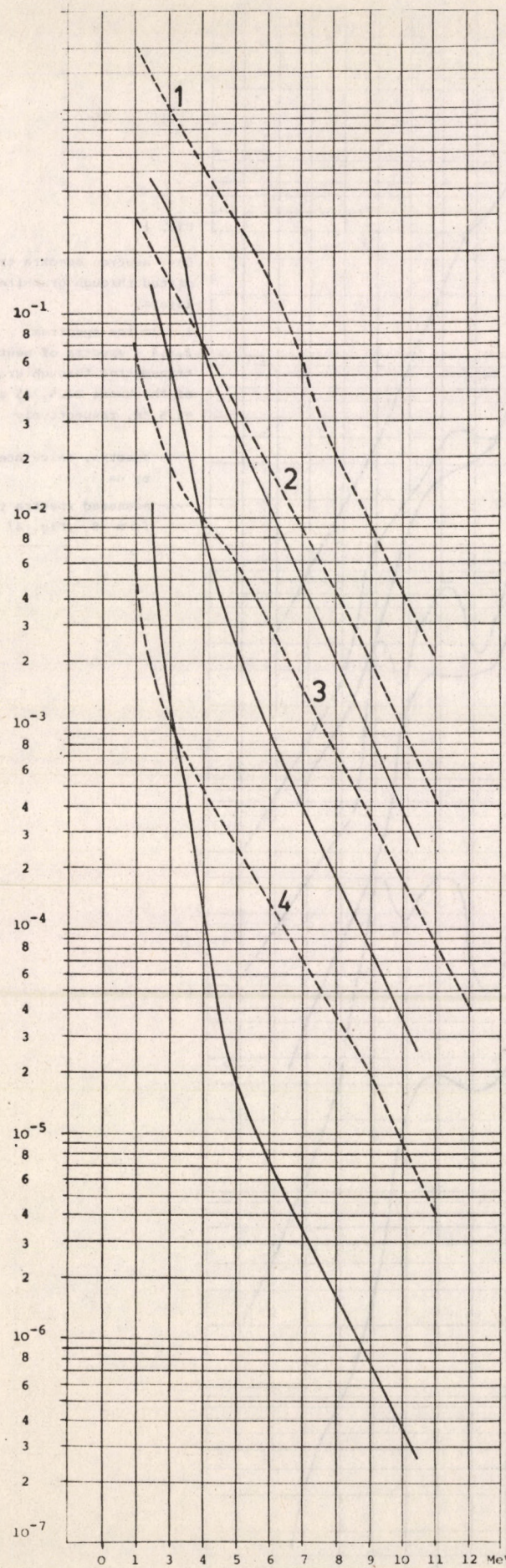

Fig. 2

Fast neutron spectra transmitted through iron layers

1 - source spectrum,
2,3,4 - spectra of neutrons transmitted through iron of thickness 10.4, 20.4 and 40 cm, respectively

—— spectra, calculated by us

---- measured spectra taken from 8 /Fig. 8/

61.977

Kiadja a Központi Fizikai Kutató Intézet
Felelős kiadó: Szabó Ferenc, a KFKI
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Budapest
1971. december hó